

## Critical analysis of Six Sigma implementation

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The Six Sigma programme has recently gained popularity throughout the world. There are a number of claims of its successes as well as failures. Successful claims are mostly supported in the literature with the popular case studies of Motorola, GE, and some other American companies. Based on the popularity of these success stories, many companies started implementation of this programme. Some did it successfully while many failed to achieve the desired results. This paper explores and analyses the critical success and failure factors of implementing Six Sigma in organisations based on lessons drawn from real life practices and case studies, as well as available literature. The paper also draws useful conclusions and recommendations for strategists, CEO's and quality managers on how to effectively implement Six Sigma.

**Keywords:** Six Sigma implementation; Six Sigma metric; Six Sigma structure; Six Sigma methodology; total quality management (TQM); ISO 9000

### Background

Total Quality Management (TQM) is a sub-discipline of management science which aims to define, set, control and improve the effectiveness of an organisation within its constraints. It has been named and labelled by different nomenclatures in its evolution over the last 60 years or so, such as quality control (QC), quality assurance (QA), total quality control (TQC), company-wide quality control (CWQC), TQM, or quality management systems (QMS). Since then, a paradigm shift in the core concept has occurred in the field of TQM by expanding the process of measurement, control and improvement from the testing/inspection departments to all departments in all types of firms, which may be manufacturing or service. Having implemented TQM, it means that the organisation is essentially using the philosophy of standardisation, customer satisfaction and continual improvement. For this purpose, this field uses many tools, methods, standards or programmes continuously being evolved by top class practicing companies, practitioners, or academicians. Six Sigma is the latest entry in this field.

### Introduction

Six Sigma is an improvement methodology in the field of Total Quality Management (TQM). It is defined as 'a methodology for pursuing continuous improvement in customer satisfaction and profit that goes beyond defect reduction and emphasizes business process improvement in general' (Breyfogle III, 2003). It aims for an error free business environment (Pyzdek, 2003). It was originally introduced in the US by Motorola in the late 1980s

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and became popular elsewhere in early 1990s. The case studies of Motorola, followed by GE and Allied Signals, generated an interest in Six Sigma (Breyfogle III, 2003). This tool became the focus of attention for CEOs and quality managers in the late 1990s, at a time when stagnancy and criticism of ISO 9000 was rising about its effectiveness with respect to making improvements in organisations.

Other TQM tools like Kaizen and quality circles were also in use for decades but did not achieve too much popularity in companies. They were initially found in Japanese or their associated firms but later accepted by firms throughout the world. The literature and real life observations provide ample justifications for the success of these Japanese tools in all sorts of companies and all parts of the world, especially Asian countries. These tools were generally labelled as *processes for slow incremental improvements*. They are considered as tools of problem solving and improvement at the level of workers or supervisors. In terms of complexity, Kaizen is the simplest tool to solve commonsense problems (a suggestion system); whereas, quality circles/teams provide problem solving platforms utilising elementary level analysis and statistical tools. Six Sigma, on the other hand, is a tool to be practiced at the level of management to deal with complex organisational problems that need extensive analysis of data, confirmation of results, and validation of long-term actual benefits. In other words, it provides more promises to management to solve deep rooted and complex performance issues of their organisations. It is, therefore, usually labelled as a tool which strives for *breakthrough improvements* rather than slow and simple improvements.

This paper will present the key elements of a Six Sigma programme and their critical analysis. It will include: (1) implementation models; (2) relationship between Six Sigma and ISO 9001 QMS; (3) Six Sigma – an approach, a methodology, a metric, or a programme; (4) a social taboo; (5) problem solving – oversimplified; (6) how much statistics; (7) mis-concepts about 3.4 DPMO; (8) Six Sigma structure; (9) Six Sigma deployment; and (10) conclusion.

### Research methodology

This paper is a critical review of the subject of Six Sigma from an academic, as well as an application, point of view. It is the result of extensive literature study as well as many real life Six Sigma implementation processes and observations. Like usual research outputs, case studies are not part of this paper, rather an exhaustive review of Six Sigma application phenomenon was carried out in order to identify key factors involved in it. It mainly identifies some important practical phenomena which are usually neglected by academicians in their usual research. These will help other researchers to plan their researches.

### Implementation models

Many professionals, including TQM practitioners sometimes erroneously confuse two things with each other, that is: (1) TQM assessment models; (2) TQM implementation models (Moosa, 2007b). The TQM assessment models are commonly known as Quality Award Criteria, Business Excellence Models, Six Sigma or even ISO 9001 QMS, and provide the *contents* of what may be considered TQM. Whether it is the DMAIC Methodology of Six Sigma (Define, Measure, Analyse, Improvement, and Control), PDCA model of ISO 9000 (Management Responsibility, Resource Management, Product Realisation, and Measurement, Analysis and Improvement) or the Business Excellence Model of European Quality Award, they all provide a checklist of activities or requirements and what is

required from a firm or an organisation. These models are prepared from the point of view of assessors who assess whether these organisations fulfill these requirements.

However, when it comes to the deployment or implementation of these models, practitioners do not find any standard methodology or model that spells out as to how to implement them. For example, ISO 9001 QMS is a set of requirement of the standard, whereas ISO 9000 and ISO 9004 are the guidelines which describe what is meant by ISO 9001, not how to implement it. Similarly, DMAIC is a standard set of problem solving process in Six Sigma methodology. These are not the guidelines on how to implement the requirements. Perhaps, it may not be possible to come up with a common set of standards on *implementation* as every organisation has different resources, context, history, competitive position, skills, technology, leadership, focus of attention, and so forth. Lascelles and Dale (1991) identified six levels for the adoption of TQM. These levels are: uncommitted, drifter, tool pusher, improver, award winner, and world class. However, when analysing them critically, these are found to be the types of TQM implementation and not the stages of TQM implementation. This is also seen in case of Six Sigma. A number of case studies are seen in the literature (Breyfogle III, 2003; Pyzdek, 2003; McCarty, 2005) which describe different styles of Six Sigma implementation. However, no proven or tested model which can be generalised, has yet been identified.

The success and failure of most Six Sigma programmes largely depend upon their implementation rather than their contents. Though not much of data is available on the failure and success rate of Six Sigma implementation, it is generally believed that only a small number of organisations who start this programme succeed, whereas a large number of them fail. According to an observation of 12 firms by the author adopting Six Sigma, it was found that one fourth of this programme achieved some significant improvements in organisations. Similarly, Eskildson (1994), based on survey results, states that the two main reasons for the failure of quality initiatives are vague definitions and objectives of respective TQM or its tools, and its inappropriate implementation. Thus, it is an issue of considerable concern to identify why these quality initiatives or programmes fail so often and how to improve their level of implementation.

### **Relationship between Six Sigma and ISO 9001 QMS**

The second revision of ISO 9001:2000 also emphasised improvement. It introduced the 'process approach' as one of the key ingredients of a Quality Management System (QMS). This was based on the world-popular Deming Cycle (PDCA). The emphasis was on 'Quality Improvement', rather than just assuring quality. However, no tool or methodology is prescribed in this standard. As a result, even knowing the requirements and process of improvement actions, most quality managers, auditors and consultants are neither focused nor skilled in the tools of quality improvement. Without understanding and implementing effective tools of quality improvement, for example Six Sigma, the revised standard has in fact not made any significant impact in organisations. As a result, while some companies claim benefits from this standard, most do not. It is, therefore, also important for companies already implementing ISO 9001:2000 to carefully integrate their QMS with Six Sigma in order to achieve its full benefits. At the same time, Six Sigma has also not been sustainable in an environment where there is a weak QMS or a QA programme being implemented. It is therefore important for companies to first identify what their current weaknesses are in their existing QMS and then strengthen it by integrating it properly with the Six Sigma methodologies to ensure the success of both.

### Six Sigma – an approach, methodology, metric, or programme?

This is a common confusing point for laymen. In fact, all the terminologies are commonly used and practiced. As an *approach*, it means that management of a firm agrees to adopt a databased problem solving approach when solving business and quality related problems. It includes all the business processes. As a *methodology*, it means that these problems are solved by management teams with a sequence of steps called DMAIC. These steps are known as a scientific method to problem solving (also taught in universities to researchers as a research methodology). Problems are identified as projects and then solved in steps where a number of statistical and analytical tools are defined at each step. As a *metric*, it uses the measure of sigma, DPMO (defect per million opportunities) and RTY (rolled throughput yield), instead of commonly used DPU (defect per unit) measures, as explained in the next section. When the word Six Sigma *programme* is used it implies a Six Sigma management system which encompasses both the Six Sigma metric and Six Sigma methodology. It is when Six Sigma is implemented as a management system that organisations see the greatest impact (McCarty, 2005). The Six Sigma teams are always sufficiently trained to ensure appropriate competence in the use of various necessary tools and techniques (commonly known as green and black belts). If such teams stop to function, the Six Sigma programme stops.

### A social taboo

One of the biggest differences between an underdeveloped and a developed country is the use of systematic approach in everything that they do or not do. The concept of ‘systems’ is practically very weak in most of the underdeveloped countries. Application of *systems approach* in a country is what makes her a developed country. We commonly observe violation of systems as a way of life in underdeveloped or developing countries. This difference usually strikes people from underdeveloped countries when they visit developed countries, where usually ‘systems’ are a way of life. Systems are mainly the routines being followed by people in general; where reminders are not required and the honesty of commitment is never questioned.

An impact of following or not following systems in our daily life is always reflected in management styles. In a society where systems are often violated by people, this by itself becomes a management style (or habit). Such styles are often the cause of lack of failure or sustainability of any management programme that we introduce in our firms. Most research also neglect to mention such styles as a root cause. Thus our focus of attention in failures is quite often at finding the technical flaws in the programmes rather than our management styles. When this happens, TQM in general and Six Sigma, in particular, suffers from these management styles and results in a failure in most implementation programmes. It is therefore important to recognise this social taboo and focus on it to improve the rate of success, especially in the Middle East and subcontinent.

People often tackle this issue by looking for people who can work effectively in a non-systematic environment. Competent and energetic people are then searched who can deal with problems competently and solve issues on a day-to-day basis without causing any disturbances. Organisations are usually run this way in underdeveloped countries. Although this does solve problems at some level, it then also creates more problems at other ends. For example, the work gets dependent on these special people (champions), job rotations become impossible, creativeness is killed, de-motivation generates and so forth. Problems are popped up again and again as people leave or change organisations.

### Problem solving – often oversimplified!

The use of word ‘problem solving’ is very common in our daily life and thus does not catch much attention when talked in the context of quality management. Even a child knows how to solve problems. So what is the big deal with Six Sigma?

Delays, rejections, errors, mistakes, losses, and inefficiencies are all problems of not just an organisation as a whole but are found in every department or section of an organisation. When problems are created regularly by one department, they become a regular feature of others’ processes. Say for example, regular delays by a Purchase Department in purchasing is not just a problem but a cause of many problems of other departments: planning errors, production delays and long stoppages, maintenance delays and long shut-downs, broken promises by the Sales department, customer complaints, employees irritation and dissatisfaction, for example. In return, all of these problems further aggravate and create more problems: such as customers’ dissatisfaction and disloyalty, vendors dissatisfaction and disloyalty, employees dissatisfaction and lower retention rates.

Fixing systems and improving the culture of following systems is therefore an important strategy for quality improvement in general. Considering the social taboo discussed earlier, problem solving becomes an act of correcting (or fixing) the bad incidence rather than focusing on the systems behind the incidence. This is not just a philosophical point of discussion which require the attention of management, but a technical point which requires problem solving tools, techniques, methods, and management policies and commitment. For example, when our intention is to discover flaws in

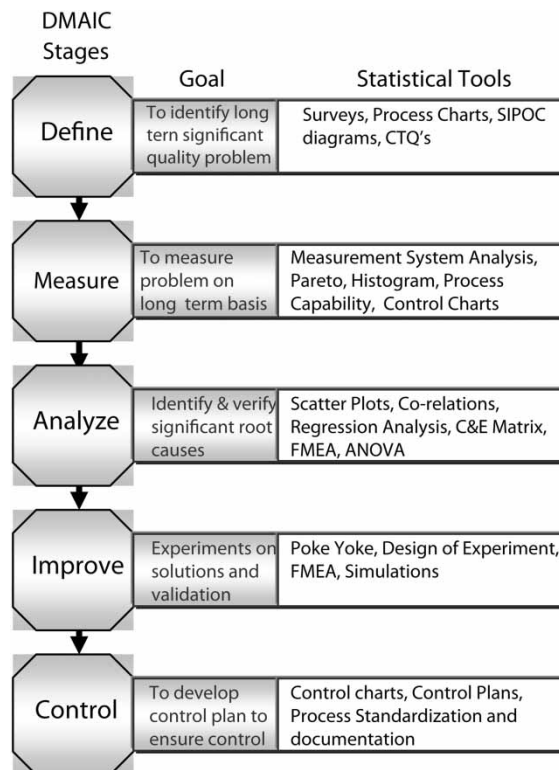


Figure 1. DMAIC process, goals and usual tools.

systems, we need to have a strong process of measurement and analysis of the systems, such as data collection of problems on a long-term basis, statistical tools, statistical software for processing data, and controlled experimentations. Six Sigma provides statistical and other analytical tools to process complex problems with the help of DMAIC Methodology (Figure 1). It usually requires sophisticated software like Minitab ® or SPSS ®. However, if these tools are not properly learnt by all concerned, the abilities to solve and analyse problems remain limited. This means the core competence of managers needs to be upgraded on statistical and analytical tools, as well as abilities to use statistical software.

### **How much statistics?**

Quality is only as good as the information and data behind it. Solving quality problems requires that large amounts of data are collected, analysed, deciphered, and acted upon. Product and service quality is only as good as the quality of the process information and data generated (for example customer feedback reports, inspection reports). Data and information therefore must be accessible and understandable to management, quality improvement teams, and all employees. Statistics can be used to make data and information understandable for quality decision-making.

Statistics involves collecting, processing, and then presenting data in an understandable form. Statistical analysis provides techniques and tools for studying variation and patterns by examining data samples to estimate characteristics of the phenomena. More often, managers are not even trained on the application of basic statistics resulting in their insufficient capabilities to analyse and infer data effectively.

Those who adopt Six Sigma, generate a data-driven management style and make use of elementary to medium level applied statistics in all business function units. Green belts are those who are trained to a basic level of techniques while black belts are trained on the advance level of applied statistics (McCarty, 2005). Two types of statistics are addressed in problem solving: (1) descriptive statistics; (2) inferential statistics.

Descriptive statistics is used for summarising and characterising data. It provides quantitative measure of the characteristics (such as the average and standard deviation) of sample data. It has useful application in almost all areas where quantitative data are collected. It can provide information about the product, process or some other aspect of the QMS, and may be used in management reviews, for example summarising key measures of product specs, describing process performance, characterising delivery time or response rate, and displaying distribution. It usually includes the use of mean, median, mode, variance, standard deviation, process capability index, different types of distributions and control charts.

On the other hand, inferential statistics is about studying the sample (customer feedback, employees' feedback, process data, experimental data) and then interpreting results about the whole phenomenon or data (long-term process). It also aims to explore the relationships (associations), especially causal relations followed by their validation. Six Sigma extensively utilises these techniques, such as sampling techniques, probabilities, test of hypothesis, analysis of variance, correlation, regression analysis, and design of experiments. These techniques, if taught to managers, raise the level of their analytical capabilities tremendously. Six Sigma includes the investigation of causal relations in complex systems through the use of these statistical techniques.

However, it is commonly observed that many training programmes throughout the world which claim Six Sigma black/green belt certification are not capable enough to



develop these skills, resulting in qualified but incapable persons. They do provide fancy certificates but very little statistical capability which can be used in real life problems.

### **Mis-concepts about 3.4 DPMO**

The value of 3.4 Defects per Million Opportunities is commonly quoted as an ultimate goal of quality in Six Sigma. However, very few understand what this really means.

It is important to note that 3.4 DPMO does not mean 3.4 defects per million product or services produced. Most people are found to have this misunderstanding. Defects per Unit (DPU) is a day to day common metric (unit of measure), which we use for measuring defects in a whole product without considering its constituent parts. In DPMO, we do take into consideration the number of parts (or opportunities) from which a product is made. The following examples will clear this point:

#### ***Example 1***

Suppose you produce 100 pens. Each complete pen has two parts, that is the lid and its refill. After checking, 10 defects are found in the whole lot of 100 pens. The calculations will be as follows:

Parts per product: 2

Defects: 10

Units: 100 (products)

DPU: 0.1 OR 10% (defects per unit or product)

DPO:  $\frac{10}{2 \times 100} = 0.05$  or 5% (defect per Opportunity)

DPMO:  $DPO \times 10^6 = 50,000$  Defects Per Million Opportunities

$\sigma$  (Sigma Level) = 3.1 (FROM SIGMA TABLE)

#### ***Example 2***

Now suppose the same lot and same number of defects but the number of parts in the same pen are four, instead of two (as in the previous example). The calculations will now be as follows:

Parts per product: 4

Defects: 10

Units: 100

DPU: 0.1 OR 10% (Defects per unit-same as previous)

DPO:  $\frac{10}{4 \times 100} = 0.025$  or 2.5% (Defect per Opportunity)

DPMO:  $DPO \times 10^6 = 25,000$  Defects Per Million Opportunities

$\sigma$  (Sigma Level) = 3.4 (FROM SIGMA TABLE)

#### ***Example 3***

Now consider the above problem (example 2) but change the number of defects to 100. The calculations will now be as follows:

Parts per product: 4

Defects: 100

Units: 100

DPU: 1.0 OR 100% (Defects per unit)

DPO:  $\frac{100}{4 \times 100} = 0.25$  or 25% (Defect per Opportunity)

DPMO:  $DPO \times 10^6 = 250,000$  Defects Per Million Opportunities

$\sigma$  (Sigma Level) = 2.2 (FROM SIGMA TABLE)

### **Interpretation**

- *Example 1:* The DPU was 10% while DPO was 5%. DPO means defect rate in every part, that is five defects in 100 parts or 50,000 defective parts in a million parts.
- *Example 2:* The DPU was still 10% while DPO was 2.5%. This means 2.5 defects in 100 component or 25,000 defective parts in a million parts
- *Example 3:* The DPU was 100% while DPO was 25%. This means one defective part in every four parts. Although 100% of pens are defective but when we consider at the level of parts, it is 25% only, that is 250,000 defective parts in a million.

So it is apparent that the sense of DPU is different from the sense of DPMO. In the above example, the opportunities are the number of parts. However, it is not always the parts only (more study may be required to grasp this further). Similarly, the opportunities in a service environment may be the number of questions in a customer feedback form. A defect may be any rating of 1 or 2 (on a scale of 5). Detailed discussion is beyond the scope of this paper.

Many people do not distinguish between DPU and DPMO, thus making conceptual errors. This mistake is quite often seen in the people interpreting the sigma levels into common sense. Sigma levels are also calculated on a long-term basis (months and years, rather than hours and days).


From the above examples, another very important issue can be identified. That is, if your product (or service) comprises of more than one component (or service parameter), the result of DPMO will differ. Table 1 will clear this concept.

The first column includes the figures of average percentage defect rate for each part of the listed products. The second column provides its relevant sigma level. The third, fourth, fifth, sixth and seventh column are examples of products with two parts, five parts, 10 parts, 100 parts and 1000 parts from which they are made (considering these as opportunities). These columns provide the yield or percentage of products as a result of the average defect rate provided in the first column. The first row, for example, considers an average defect rate of 20% for each part being used in the product. In such cases, the shoe manufacturer will have only 64% of defect free final products. If it was a pen which contain five parts in a product, it will have 33% defect free products after assembly; if it is a shirt with 10 parts in it, then 11 shirts will be defect free after production; if it is a computer, it will have 0% (no) defect free computer after assembly; and if it is an automobile, it will also have no defect free car after assembly.

Looking at the table, it will be seen with an 1% average defect rate of each part in a product, 98% shoes, 95% pens, 90% shirts, 37% computers and 0% cars will be turned out defect free after assembly or production. In order to produce 90% cars without any defect, the automobile manufacturer will have to set its processes and vendors defect rate at 0.001%. This means the sigma level of 5.2 at the process or vendor level will produce 2.8 sigma cars (the calculations are beyond the scope of this paper). The same type of sigma calculations can also be carried out in case of services. Different types of product manufacturers or service deliverers cannot compare their products or service



Table 1. A table showing yield percentage (yield%) based on number of components in the product.



Ave def rate % of each part	Sigma level	2 Parts (Yield%)	5 Parts (Yield%)	10 Parts (Yield%)	100 Parts (Yield%)	1000 Parts (Yield%)
20%	2.4 $\sigma$	64%	33%	11%	0%	0%
15%	2.6 $\sigma$	72	44	20	0	0
10%	2.8 $\sigma$	81	59	35	0	0
5%	3.2 $\sigma$	90	77	60 (1.8 $\sigma$ )	0	0
4%	3.3 $\sigma$	92	82	66	1.7	0
3%	3.4 $\sigma$	94	86	74	5	0
2%	3.6 $\sigma$	96	90	82	13	0
1%	3.9 $\sigma$	98	95	90 (2.8 $\sigma$ )	37 (1.2 $\sigma$ )	0
0.1%	4.6 $\sigma$	99.8	99.5	99.0	90 (2.8 $\sigma$ )	37 (1.2 $\sigma$ )
0.001%	5.2 $\sigma$	99.9	99.9	99.9	99 (4.6 $\sigma$ )	90 (2.8 $\sigma$ )
0.0004%	6.0 $\sigma$	99.9	99.9	99.9	99.9	99.6 (4.2 $\sigma$ )

processes by percentage of defects measured in DPU. The number of parts which make up their products or service is an important parameter which is not addressed in DPUs but accounted for in DPMO (or sigma). Therefore, DPMO and sigma values are useful metrics to compare two different products and their processes. For example, a TV manufacturer can compare its process quality with a pen manufacturer. The same is true in the case of services.

This suggests that as the number of parts in a product increase so does the complexity of quality. It is therefore much more difficult to control the quality of an automobile than shoes. In other words, two equal quality processes (say 5% defect rate) will produce different quality levels of products if the number of parts from which they are made varies. Process improvement is, therefore, of much higher priority for companies whose products or services comprises many constituent parts.

### Six Sigma structure – no new posts but new competencies

Black Belt is a full time Six Sigma practitioner who has had rigorous training in the statistical methods used to gather and analyse data in a Six Sigma project. Green Belt is a Six Sigma practitioner, usually part-time, who has been trained in the Six Sigma DMAIC problem solving methodology and basic statistical tools; whereas champions are heads of business divisions or process owners who run the processes (McCarty, 2005) (see Figure 2).

These belts do not suggest any new structure than usually defined in TQM. They only represent the statistical and problem solving skills and knowledge of people involved in the process of problem solving. Process owners or champions request the quality manager (who may be black belt) to form a team from respective departments (usually green belts) where there is a problem. Thus, problems are solved by process owners who are trained in medium level statistical tools and DMAIC methodology under the guidance of a black belt (quality manager) who has advanced skills in statistical tools to carry out statistical tests and experiments (Breyfogle III, 2003; McCarty, 2005; Pyzdek, 2003).

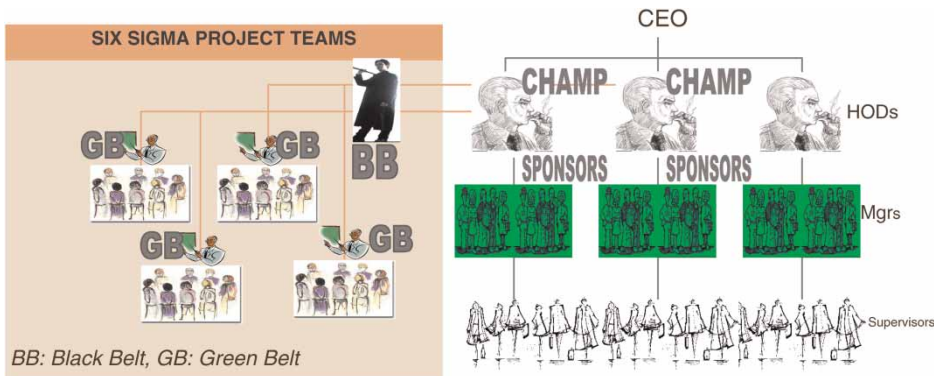


Figure 2. Six Sigma projects carried out by BBs, GBs, Champions and Sponsors.

Thus it is not the creation of posts of belts, but rather raising the level of competencies of management. They should be able to analyse data effectively and confirm significant factors that have causal relations with the outcomes. The Six Sigma project teams are formed in parallel to the functioning of departments controlled by the quality manager or a black belt.

### Six Sigma deployment

There is no standard method or model available for Six Sigma (as well as TQM) implementation. Most other frameworks of quality management, such as ISO 9000 or quality awards define the contents or requirements, and are usually known as *assessment models*. Since there are no implementation models for the organisations to follow and little guidance is available in this domain throughout the world, organisations therefore feel difficulty when it comes to their implementation. Most successes or failures of Six Sigma largely depend upon its effective or ineffective implementation. Successes and failures are generally attributed to many social and other aspects of organisations, which are ignored during the phases of its implementation, for example the context, history, competence of people, leadership and management style, focus of attention, organisational culture and environment, resources, level of knowledge and skills of employees, organisational priorities, management priorities, turnover rate, market pressures and so forth. Organisations behave in a different way in different circumstances at different point of times, and even at different locations. Even most of the multinational companies with tremendous resources and skills also fail to implement Six Sigma with the same efficiency, effectiveness and even values, in their different plants and offices. In some countries, they succeed in implementing Six Sigma whereas in another they fail. A uniform way to implement Six Sigma usually remains a myth.

Although case studies printed in journals and magazines provide good guidelines in this aspect, they usually lack adequate details on the social aspects of implementation, and its sequences and details. Even most of the scholarly literature available is focused on *principles, phenomena, and techniques* of Six Sigma. Consequently, social aspects of implementation are underestimated, undermined or undiscovered during the implementation phase. Ample research opportunities are available in this domain provided the researcher understands well and is conversant with the implementation processes.

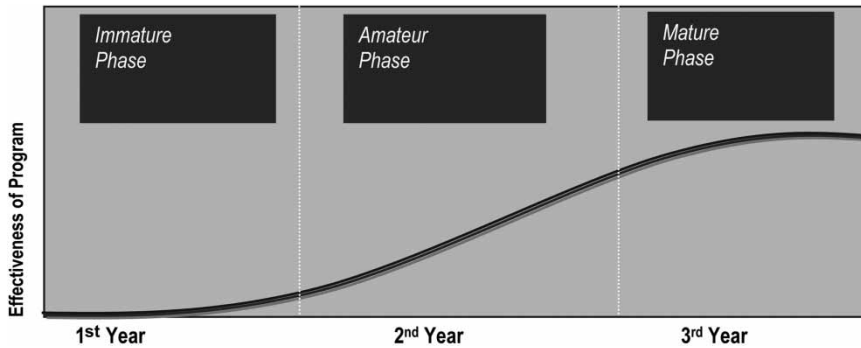


Figure 3. S curve (learning curve) of Six Sigma (also common to other systems).

### *Two unique characteristics of implementation*

Firstly, the implementation of programmes like Six Sigma, as well as other TQM tools is not a one-phase process. It is usually done in multiple steps or stages expanding over a few years. As an analogy, consider the root canal treatment of teeth. It does not take just one visit to a dentist for the treatment. Patients require many sittings with dentists to have the treatment completed. Dentists proceed with next step of the treatment only when sufficient progress has been achieved in the preceding treatment. At times, these sessions may be take three or four visits or even beyond, as progress differs from one patient to another. Therefore duration of treatment cannot be fixed in terms of time. Similarly is the case with Six Sigma implementation. Say, for example, the analysis phase of DMAIC. Every organisation or Six Sigma team will have its unique experience due to the different nature of problem, available competencies in the team and priorities. Thus the Six Sigma implementation processes and styles differ from company to company, country to country, location to location, and even from time to time.

Secondly, Six Sigma programmes have different learning curves in different organisations. It usually starts with naive steps and progressively gets matured and can be reflected with an S-Curve as shown in Figure 3.

There are usually three distinct states in getting maturity: (1) immature state, the starting state where it may or may not be integrated fully with other organisational functions; (2) amateur state, that is the state where people are at the basic level of know-how and lack experience; and (3) mature state, where Six Sigma gets robust and becomes part of the organisational culture. People normally play around in the initial two phases, and tend to neglect different aspects in their daily routines. Thus these stages require regular reinforcement and follow-ups. If these first two stages are successful, the maturity starts. As these practices become part of the routines and habits of people, the need for reinforcement is minimised. New habits improve the overall organisational culture. Management usually gets frustrated in the first or second phase where a lot of *teething* problems arise. Many abandon it at this pre-mature stage. This by itself is a pre-mature management. If the rate of learning of Six Sigma teams is slow in the first two phases of the project, the maturity is never achieved and people also tend to abandon it or standardise sub-standard Six Sigma programmes.

### *Is Six Sigma implementation a project or a programme?*

This is a common debate among academicians and practitioners. Quite often the debate is based on the literary meaning of the words, rather than its broader concepts. In fact, Six Sigma implementation has both components as shown in Figure 4.

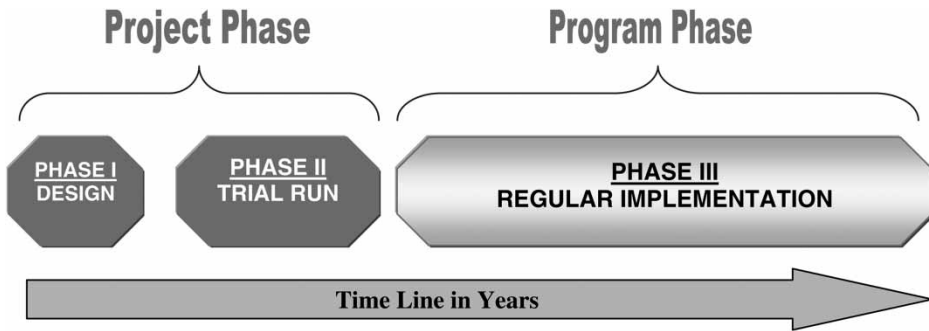


Figure 4. Implementation – project and programme phases.

The project phase of Six Sigma is generally known as the initial training, development and the trial initiatives. In this phase, consultants are hired by many companies, hence the terminology of ‘project’ is used. The project closure is supposed to be a successful completion of a few Six Sigma projects in a company or initial certification, as in ISO 9001 QMS (Moosa, 2007a). As soon as the consultants abandon the teams, the project should never stop.

After the initial few successful trials of the Six Sigma teams, the project moves to the *programme phase*. Some of the mechanics of the programme phase differs from the project phase. For example, in the first two phases, it was taken by the management as a challenge or an assignment for that particular year. As the project achieves initial success, the assignment usually ends for the heads of departments (sponsors), and new challenges and assignments are given to them. The accountability of Six Sigma usually ends at this stage, leaving the programme stage at jeopardy. Rewards or awards are given for the first time or a few times. The interest level of management may slow down as other areas of interests come along in subsequent years. At this stage Six Sigma activities diminishes, in terms of efforts, focus and priorities. This is the point where most Six Sigma programmes are damaged and later abandoned.

### ***Seven stages of TQM and Six Sigma implementation***

After having studied the process of TQM implementation and its various tools, including Six Sigma, in a large number of organisations during recent years, the author has identified seven stages of Six Sigma implementation (Moosa, 2007b) (see Figure 5). It is based on practical experiences of working as a consultant and conducting empirical studies. The seven stages are:

- (1) Envisioning
- (2) Strategising
- (3) Developing
- (4) Implementing
- (5) Improving
- (6) Sustaining
- (7) Abandoning

#### ***Stage 1 – Envisioning***

This is the initial stage where an interest in quality improvement and Six Sigma is generated among the management of organisations. This interest is mainly initiated through

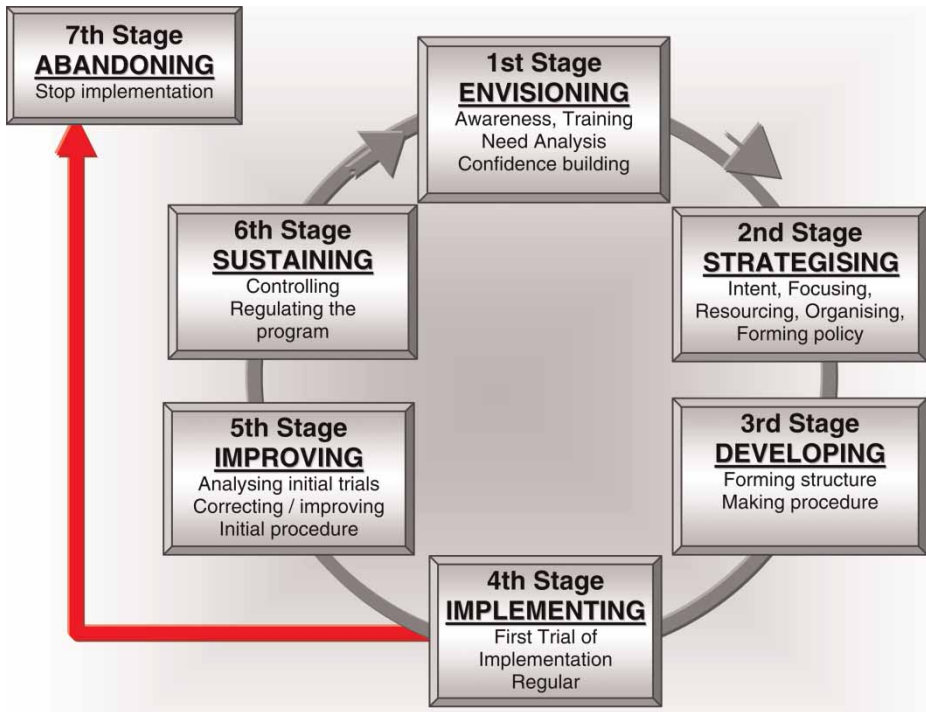


Figure 5. Seven stages of Six Sigma implementation (Moosa, 2007b).

training, conferences, observations, studies and is further enhanced as concepts and knowledge increases in this field. This interest takes the shape of a vision for attaining a higher level of quality – only if the level of understanding is strengthened. A number of mature trainings are required to strengthen this vision. The most common aspect at this stage is the training of the top management. Company visits and conferences are also effective.

#### *Stage 2 – Strategising*

This involves the real *intent* to implement Six Sigma and the decision to start the project, creating a focal point for Six Sigma, planning the project, identifying and creating necessary resources and roles, organising the project and forming a policy on quality and Six Sigma. Though it sounds so simple, this is the most important part of the entire project. Sufficient know-how is required to identify the required structure and roles. Just forming committees and appointing a Six Sigma manager without details of their roles, responsibilities and authorities, does not impact the project effectively. The need for the particular type of structure suitable to the organisation for both the project, as well as program stages is a careful and thoughtful consideration that also requires experiential inputs. People who learn Six Sigma through books usually jump to the next stage, that is, *developing* without fully grasping this stage. If the programme is based on a weak structure, it is sooner or later bound to stall. Tasks are usually assigned to individuals without any considerations of their existing role and efficiency. It is important not to restrict the thinking on Six Sigma implementation to initial trials, but also towards regular

implementation in subsequent years. This will involve forming a policy to raise the core competence of the whole management on statistical analysis and DMAIC processes.

### *Stage 3 – Developing*

This includes two main activities: developing the necessary roles and appropriate project structure, and developing Six Sigma procedures and processes. Competence on minor details is also required at this stage. Benchmarking also helps. It requires building the medium and high level Six Sigma skills through Green and Black Belt trainings, as well as identifying the suitable roles and project planning for the first trial of implementation.

### *Stage 4 – Implementing*

The initial implementation phase of the first year is usually the *trial* phase and the success and failures encountered in the initial phase are not necessarily the real success or failures of the programme – just like the honeymoon period in a marriage, which is not in reality a guarantee for the success or failures of the marriage in subsequent years of life. Likewise, poor quality of training of green/black belts, assigning roles without accountability or serious intent, deficiency of resources, identification of unnecessary resistance posed by certain individuals who are either not capable or interested, lack of cohesive approach to Six Sigma in the senior management, and the incapability of the quality managers are mostly the main discoveries at this stage.

Implementation is the stage when actions starts, that is Six Sigma project teams are formed and they start their work on the problems and identification of their root causes. The earlier stages are mostly discussions, trainings and planning. According to George Eckes who has been involved in Six Sigma implementation in the USA, of the 20–30 processes in an organisation, usually 7–10 will be part of the first implementation efforts. Of those 7–10 projects, between 4–7 projects will probably be successful. These first projects will help generate increased enthusiasm and momentum for future Six Sigma activity in an organisation (Eckes, 2003).

With respect to project management, careful and forceful project tracking is required at this stage. The CEO and Head of the Six Sigma programme (called Champions) need to push some people, drag others, and penalise some others. This stage suffers if a strong driving personality is not present in the organisation. If this happens, people tend to blame the Six Sigma itself, rather than their mismanagement of the project. Usually the implementation phase involves one or more cycles of implementing Six Sigma project teams. It may extend from a year to two years. The project phase is usually over at this point and the programme phase starts thereafter.

### *Stage 5 – Improving*

After the successful or unsuccessful initial implementation phase, people tend to either give up or reduce their synergy. This is due to many factors as pointed out earlier. In projects like ISO 9000, many organisations consider certification as the end result of the project. This is because certification is usually considered and planned as the project end. Certification by a third party is declared as a success, even without achievement of the actual quality outcomes, that is performance improvement. This phenomenon has misled hundreds of organisations. Usually, no Six Sigma process is neither complete nor in its right shape in the initial year. There are two requirements at this stage: check



the improvement trends and verify whether the Six Sigma process worked correctly to achieve the desired goals. If these requirements are not met, then the policies and procedures need to be revised and improved. In case of a positive trend in improvement, then this process needs to continue for many more cycles with the same energy, zeal and leadership. In addition to that, there is also the need to plan for the expansion of Six Sigma to strengthen the overall programme and make further improvement goals or enhancing the scope of the project.

### *Stage 6 – Sustaining*

After fixing initial teething problems and removing initial deficiencies, the Six Sigma project needs to be transformed and maintained into a regular programme. Maintaining the programme does not mean only the continuity in the defined procedure, but also continuity in the leadership strength, interest, motivation and the priority level. The revised priorities actually change the organisational culture. Therefore, at this stage, cultural changes take place. Improvement made as a result of problem solving actually creates the waves of change. If sustained properly, changes occur and if not, changes stall or are undone. Undoing the changes mean people tend to revert to old and original practices.

### *Stage 7 – Abandoning*

This is not necessarily the last stage. This may happen at any stage, and most commonly after the initial implementation, that is the trial phase. Abandoning could be due to numerous factors, but most common are not the technical ones. Rather, these are social issues discussed earlier in this paper.

## **Conclusion**

The Six Sigma is a positive approach to make breakthrough improvement by involving managers at all levels in any organisation. However, it is not magic which will happen by hiring any good trainer, black belt or consultant. It requires good vision of the top management, appropriate strategies based on experiences, practical and hands on training to managers that actually takes them through the use of advance statistical tools using the DMAIC processes; effective coordination through proper project management in the first 1–2 years; and leadership of quality which demands effective accountability, motivation and teamwork from managers. Any initiative in the right direction with the right approach and right tools is a guarantee for success. Failures do not require much effort.

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